Engineering Alternative Studies for Separations

Waste Generation Forecast and Characterization Study - 800 MT/year UREX+1a

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APPROVALS

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Summary of Revisions

Issue Date	Revision	Description
6-20-07	A	Issued for review and comment
7-11-07	B	Issued to support NEPA documents
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5-22-08	1	Deleted Appendices A through C. Renamed Appendix D to Appendix A. Corrected minor editorial mistakes. Removed OUO/AT markings. Issued for PEIS use.

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ACRONYMS

BOP	Balance of Plant
CCD	Chlorinated cobalt dicarbollide
CFR	Code of Federal Regulations
DOE	Department of Energy
EAS	Engineering Alternative Studies
FP	Fission Product
GTCC	Greater Than Class C
GWD	Giga-watt Days
HAW	High Activity Waste
HEPA	High Efficiency Particulate Air
HLW	High Level Waste
HVAC	Heating Ventilating and Air Conditioning
LAW	Low Activity Waste
LLW	Low Level Waste
MT	Metric ton
MTHM	Metric Ton Heavy Metal
nCi	nano-Curies
PDS	Process Data Sheet
PEG	Polyethylene Glycol
RCRA	Resource Conservation and Recovery Act
SLB2	Standard Large Box 2
SWB	Standard Waste Box
UREX	Uranium Extraction
U/TRU	Uranium/Transuranic
TALSPEAK	Trivalent Actinide-Lanthanide Separation by Phosphorous reagent Extraction from Aqueous Komplexes
TCLP	Toxicity Characteristic Leachate Procedure
TRU	Transuranic
TRUEX	Transuranic Extraction
WIPP	Waste Isolation Pilot Plant

EXECUTIVE SUMMARY

This study provides an estimate of waste generation rates for a spent fuel separations facility with a production capacity of 800 MTHM of commercial spent fuel. Table EX-1 below provides a facility level summary of the estimated normal annual waste generation rates.

Table EX-1
Facility Level Waste Generation Summary for a 800 MTHM Spent Fuel Separations Facility

Waste Type	Volume
High Level Solid	204 m^3
GTCC Solid	956 m^3
Mixed GTCC Solid	59 m^3
Low Level Solid	25,021 m^3
Mixed Low Level Solid	16.0 m^3
Low Activity Liquid	2,156 liters
Hazardous Solid	47 m^3
Hazardous Liquid	100 liters
Non-Hazardous Solid	30,322 m^3
Non-Hazardous Liquid	$248x10^6$ liters

The waste volumes given above in Table EX-1 are "as generated" and do not consider any increases in volume due to packaging inefficiencies or any decreases in volume due to waste minimization or volume reduction techniques such as compaction. The table below provides a summary of the volume of solid waste streams with considerations made for packing efficiency and volume reduction where applicable.

Table EX-2
Packaged Solid Waste Volumes for a 800 MTHM Spent Fuel Separations Facility

Waste Type	Packaged Waste Volume – No Compaction (m^3)	Packaged Waste Volume – With Compaction (m^3)
High Level Solid	221	Not Applicable
GTCC Solid	1,250	Not Applicable
Mixed GTCC Solid	77	Not Applicable
Low Level Solid	30,988	7,936
Mixed Low Level Solid	32	Not Applicable
Hazardous Solid	93	Not Applicable
Non-Hazardous Solid	37,903	16,463

Much of the data to support the development of this study is derived from the Process Data Sheets (PDS) and the Process Flow Diagrams/Material Balance. The most recent versions of these documents were used at the time this report was prepared. This study builds upon the waste generation data developed for the PDSs and the Material Balance with additional information obtained from the system Subject Matter Experts as needed to further identify, quantify and clarify the waste streams.

Operational experience from across the DOE complex was utilized to estimate the more routine waste streams such as glovebox HEPA filters, gloves, job control waste and maintenance waste from these systems and other Balance of Plant systems. Waste data for Balance of Plant systems is determined based on facility layouts, concepts and staffing levels available at the time this study was prepared.

1.0 PURPOSE

This study provides an estimate of waste generation rates for a spent fuel separations facility with a production capacity of 800 MTHM of commercial spent fuel. The study includes refinements to the flowsheets and material balance for treating the spent diluent waste streams from the solvent extraction processes and the excess acid prior to waste water treatment. These refinements eliminate the spent diluent as a waste stream and reduce the quantity of effluent and grout from waste water treatment operations. Also, the study assumes HEPA filtration for process cell exhaust ventilation.

2.0 METHODOLOGY

Much of the data to support the development of this study is derived from the Process Data Sheets (PDS) and the Process Flow Diagrams/Material Balance. The most recent versions of these documents were used at the time this report was prepared. This study builds upon the waste generation data developed for the PDSs and the Material Balance with additional information obtained from the system Subject Matter Experts as needed to further identify, quantify and clarify the waste streams.

Operational experience from across the DOE complex was utilized to estimate the more routine waste streams such as glovebox HEPA filters, gloves, job control waste and maintenance waste from these systems and other Balance of Plant systems. Waste data for Balance of Plant systems is determined based on facility layouts, concepts and staffing levels available at the time this study was prepared.

A methodical approach to forecasting the waste was used. Waste was categorized as follows to provide a systematic approach to the waste forecast.

Operational Waste
Job Control Waste
Maintenance Waste

To aid in categorizing the various waste streams once identified, a Waste Characterization Code was utilized to help group and characterize the waste streams by waste type (e.g. HLW, GTCC, LLW, hazardous, mixed, and non-hazardous), waste form (e.g. solid, liquid) and disposition method (e.g. waste package). These codes are unique to this Study and are not to be confused with waste codes used for regulatory purposes. The Waste Characterization Code is composed of the following:

1st Character – Primary Waste Designation
- G Greater than Class C waste (also used for liquid High Activity Waste)
- H High level waste
- L Low level waste (also used for liquid Low Activity Waste)
- N Non-radioactive Waste

2nd Character – Secondary Waste Designation
- H Hazardous (contains RCRA hazardous constituents)
- N Non-hazardous (does not contain RCRA hazardous constituents)

3rd Character – Waste Form Designation
- L Liquid
- S Solid

4th Character –Disposal Package/Method
- A Universal canister for hulls, hardware, etc. (2’ diameter x 10’ high)
- C High level waste canister (2’ diameter x 15’ high)
- D Drum (55 gallon)
- E Engineered container yet to be designed
- G GTCC waste disposal container (assumed similar to WIPP standard waste box (SWB) or Standard Large Box 2 (SLB2)
- L Low level waste disposal box (typical size of 4’D x 6’L x 4’H)
- O Outfall
- S Solidified low level waste disposal box (typical size of 4’D x 6’L x 2’H)
- U Unspecified (typically used for sanitary municipal landfill waste where no specific disposal package is specified)

3.0 MAJOR ASSUMPTIONS

The following major assumptions were made in conducting this study:

1. This study identifies waste streams resulting from normal spent fuel separations operations. Waste resulting from accident conditions or decommissioning operations is not evaluated in this study.
2. Waste generation rates are based on a processing capacity of 800 MTHM of spent fuel per year (spent fuel with a burnup of 60 GWD/MT and cooled 5 years). Waste generation rates for a 100 MTHM/year spent fuel separations facility are provided in Appendix A.
3. All waste generated within process cells handling separated transuranic elements (e.g. U/TRU solidification and packaging) is considered GTCC waste.
4. All waste generated within process rooms where radioactive materials are processed is considered low level waste. Waste generated within rooms where radioactive material is processed in a sealed manner (e.g. Tc Alloy Storage, U/TRU Storage, etc.) is not considered low level waste.

4.0 FACILITY LEVEL WASTE SUMMARY

The table below provides a facility level summary of the estimated annual waste generation rates for a spent fuel separation facility with a processing capacity of 800 MTHM per year.

Table 4.0-1
Facility Level Waste Generation Summary for a 800 MTHM Spent Fuel Separations Facility

Waste Type	Volume
High Level Solid	204 m^3
GTCC Solid	956 m^3
Mixed GTCC Solid	59 m^3
Low Level Solid	25,021 m^3
Mixed Low Level Solid	16.0 m^3
Low Activity Liquid	2,156 liters
Hazardous Solid	47 m^3
Hazardous Liquid	100 liters
Non-Hazardous Solid	30,322 m^3
Non-Hazardous Liquid	$248x10^6$ liters

The waste volumes given above in Table 4.0-1 are "as generated" and do not consider any increases in volume due to packaging inefficiencies or any decreases in volume due to waste minimization or volume reduction techniques such as compaction. The table below provides a summary of the volume of solid waste streams with considerations made for packing efficiency and volume reduction where applicable.

Table 4.0-2
Packaged Solid Waste Volumes for a 800 MTHM Spent Fuel Separations Facility

Waste Type	Packaged Waste Volume – No Compaction (m^3)	Packaged Waste Volume – With Compaction (m^3)
High Level Solid	221	Not Applicable
GTCC Solid	1,250	Not Applicable
Mixed GTCC Solid	77	Not Applicable
Low Level Solid	30,988	7,936
Mixed Low Level Solid	32	Not Applicable
Hazardous Solid	93	Not Applicable
Non-Hazardous Solid	37,903	16,463

Waste streams are defined as follows:

- High level waste is defined in the *Nuclear Waste Policy Act of 1982*, as amended, as: "(a) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (b) other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation."
- Greater Than Class C (GTCC) Solid – Radioactive solid waste with a radionuclide content greater than the values shown below in Table 4.0-2 (derived from 10CFR61.55):

Table 4.0-2
Greater Than Class C Waste Limits

Radionuclide	Content
^{14}C	8 Ci/m^3
^{14}C in activated metal	80 Ci/m^3
^{59}Ni in activated metal	220 Ci/m^3
^{94}Nb in activated metal	0.2 Ci/m^3
^{99}Tc	3 Ci/m^3
^{129}I	0.08 Ci/m^3
Alpha emitting transuranic nuclides with halflife greater than 5 years	100 nCi/g
^{241}Pu	3,500 nCi/g
^{242}Cm	20,000 nCi/g
Total of all nuclides with less than 5 year halflife	Note 1
^{3}H	Note 1
^{60}Co	Note 1
^{63}Ni	700 Ci/m^3
^{63}Ni in activated metal	7,000 Ci/m^3
^{90}Sr	7,000 Ci/m^3
^{137}Cs	4,600 Ci/m^3

1. There are no limits established for these radionuclides in Class C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling and disposal will limit the concentrations for these wastes.

- Mixed GTCC Solid – GTCC Solid waste containing hazardous constituents as defined by the Resource Conservation Recovery Act (RCRA) in 40 CFR Part 261 (see Hazardous Solid waste below).

- High Activity Liquid - Radioactive liquid waste with a relatively high level of alpha and gamma activity and a relatively low fissile concentration. Based on operations at the Savannah River Site, high activity liquid waste typically has an alpha activity greater than 1000 d/m/mL, a gamma activity level greater than $1x10^5$ d/m/ml, a TRU concentration of less than 1 g/L TRU and a uranium content less than 0.65 weight percent U-235. Typically, process streams with concentrations greater than 1 g/L TRU or 0.65 weight percent U-235 are assumed to be recycled for recovery and are not considered waste. Actual threshold values for high activity waste generated by spent fuel separations operations will be determined during operational planning activities.
- Low Level Solid – Radioactive solid waste with a radionuclide content less than or equal to the values shown for GTCC waste in Table 4.0-2.
- Mixed Low Level Solid – Low level solid waste containing hazardous constituents as defined by the Resource Conservation Recovery Act (RCRA) in 40 CFR 261 (see Hazardous Solid waste below).
- Low Activity Liquid - Radioactive liquid waste with a relatively low level of alpha and gamma activity. Based on operations at the Savannah River Site, low activity liquid waste typically has an alpha activity less than 1000 d/m/mL and a gamma activity less than $1x10^5$ d/m/ml. Actual threshold values for low activity waste generated by spent fuel separations operations will be determined during operational planning activities.
- Mixed Low Activity Liquid – Low activity liquid waste containing hazardous constituents as defined by the Resource Conservation Recovery Act (RCRA) in 40 CFR 261 (see Hazardous Liquid waste above).
- Hazardous Solid – Non-radioactive solid waste containing hazardous constituents as defined by the Resource Conservation Recovery Act (RCRA) in 40 CFR 261. RCRA hazardous waste can contain either characteristically hazardous materials or listed hazardous materials. Characteristic waste displays at least one of the hazardous characteristics as defined by 40 CFR Part 261, Subpart C, such as ignitability, corrosivity, reactivity or toxicity by leach testing (Toxicity Characteristic Leachate Procedure (TCLP)). Listed wastes are defined by 40 CFR Part 261.
- Hazardous Liquid - Non-radioactive liquid waste containing hazardous constituents as defined by the Resource Conservation Recovery Act (RCRA) in 40 CFR 261. RCRA hazardous waste can contain either characteristically hazardous materials or listed hazardous materials. Characteristic waste displays at least one of the hazardous characteristics as defined by 40 CFR Part 261, Subpart C, such as ignitability, corrosivity, reactivity or toxicity by leach testing (Toxicity Characteristic Leachate Procedure (TCLP)). Listed wastes are defined by 40 CFR Part 261.
- Non-Hazardous Solid – Non-radioactive solid waste that does not contain hazardous materials as defined by the Resource Conservation Recovery Act (RCRA) in 40 CFR 261.
- Non-Hazardous Liquid - Non-radioactive liquid waste that does not contain hazardous materials as defined by the Resource Conservation Recovery Act (RCRA) in 40 CFR 261.

5.0 SYSTEM LEVEL WASTE SUMMARY

The tables contained in this section identify the various waste streams by system. The totals in each table are reflected in the facility level waste generation summary contained above in Table 4.0-1. Each waste stream is further distinguished by the Waste Characterization Code as defined in Section 2.0. The system names in the tables are shortened to the following names for practicality:

Fuel Receipt	Fuel Receipt, Storage, Disassembly and Transfer
Shearing/Dissolving	Shearing and Dissolving
Offgas	Offgas Capture and Disposal
UREX	UREX
U/Tc Separation	U/Tc Separation
Tc Solidification	Tc Solidification, Alloying, Packaging, Storage and Disposal
U Solidification	U Solidification, Packaging, Storage and Disposal
CCD/PEG	CCD/PEG
Cs/Sr Solidification	Cs/Sr Solidification, Packaging, Storage and Disposal
TRUEX	TRUEX
FP Solidification	Fission Product Solidification, Packaging, Storage and Disposal
TALSPEAK	TALSPEAK
U/TRU Solidification	U/TRU Solidification, Packaging, Storage and Shipping
Acid Recovery	Acid Recovery
Solvent Recovery	Solvent Recovery
HAW	High Activity Waste
LAW	Low Activity Waste
Waste Handling	Waste Handling
Analytical	Sampling and Analytical
Chemical Receipt	Chemical Receipt, Storage and Makeup
Balance of Plant	Balance of Plant

5.1 High Level Solid Waste (Waste Characterization Codes HHSx and HNSx)

Table 5.1-1
System Level Summary Of High Level Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving					
Offgas					
UREX					
U/Tc Separation					
Tc Solidification	HNSA	2.7			2.7
U Solidification					
CCD/PEG					
Cs/Sr Solidification	HHSE	77.4			77.4
TRUEX					
FP Solidification	HNSC	123.5			123.5
TALSPEAK					
U/TRU Solidification					
Acid Recovery					
Solvent Recovery					
HAW					
LAW					
Waste Handling					
Analytical					
Chemical Receipt					
Balance of Plant					
Subtotal		**203.6**			**203.6**
TOTAL	**203.6**				

Waste Characterization Codes used:
1st character H-high level waste
2nd character H- hazardous, N-non-hazardous
3rd character S-solid
4th character A-universal canister for hulls, hardware, etc., C-High level waste canister, E-engineered container

The following Waste Characterization Codes are reflected in Table 5.1-1.

Waste Characterization Code: HHS**E**
Description: Wastes covered by this Code are immobilized high level wastes containing hazardous constituents
Example(s):

- Solidified Cs/Sr waste from Cs/Sr Solidification, Packaging, Storage and Disposal

Disposition Path: Package into engineered waste canisters for disposal at a geologic high level waste repository
Technical Issues:

- The waste form requires qualification for disposal at the high level waste repository if not bounded by existing waste form qualification programs

Waste Characterization Code: HNS**A**
Description: Wastes covered by this Code are immobilized high level wastes in a metal alloy form
Example(s):

- Zr alloy with Tc and undissolved solids from Tc Solidification, Alloying, Packaging, Storage and Disposal

Disposition Path: Package into high level waste canisters 2' diameter x 10' high for disposal at a geologic high level waste repository
Technical Issues:

- The waste form requires qualification for disposal at the high level waste repository

Waste Characterization Code: HNS**C**
Description: Wastes covered by this Code are immobilized high level wastes in a vitrified glass form
Example(s):

- Vitrified fission products and lanthanides from Fission Product Solidification, Packaging, Storage and Shipping

Disposition Path: Package into high level waste canisters 2' diameter x 15' high for disposal at a geologic high level waste repository
Technical Issues:

- The waste form requires qualification for disposal at the high level waste repository if not bounded by existing waste form qualification programs

The following table summarizes the total annual volume of high level solid waste generated by final waste package type (i.e. universal containers and high level waste containers). Also shown in the table is the equivalent quantity of waste packages required for the given waste volume. Universal containers are assumed to be 2' diameter by 10' tall (0.9 m^3 packaged volume) and contain 3,600 kg of Tc alloy ingots per container at a density of 7 g/cc. High level waste containers are assumed to be 2' diameter by 15' tall (1.3 m^3 packaged volume) and contain 2,909 kg of glass waste per container at a density of 2.5 g/cc.

Table 5.1-2
Summary Of High Level Solid Waste Packages

Universal Containers		High Level Waste Containers		Engineered Containers	
Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity
2.7	6	123.5	106	77.4	4,075

The following table summarizes the total annual waste volume as packaged.

Table 5.1-3
Summary Of Packaged High Level Solid Waste Volume

Universal Containers		High Level Waste Containers		Engineered Containers	
Annual Package Quantity (From Table 5.1-2)	Annual Packaged Volume (m^3)	Annual Package Quantity (From Table 5.1-2)	Annual Packaged Volume (m^3)	Annual Package Quantity	Annual Packaged Volume (m^3)
6	5.4	106	137.8	4,075	77.4

From Table 5.1-3 above, the overall volume of high level solid waste adjusted for packaging is 220.6 m^3.

5.2 GTCC Solid Waste (Waste Characterization Code GNSx)

Table 5.2-1
System Level Summary Of GTCC Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving	GNSA	57.8			57.8
	GNSG			0.3	0.3
Offgas	GNSE			0.2	0.2
	GNSG	16.0			16.0
UREX					0
U/Tc Separation	GNSE			0.5	0.5
	GNSG		112.8		112.8
Tc Solidification	GNSG	0.1	112.8		112.9
U Solidification					0
CCD/PEG	GNSG		112.8		112.8
Cs/Sr Solidification	GNSE			11.9	11.9
	GNSG		169.2		169.2
TRUEX	GNSE			27.2	27.2
FP Solidification					0
TALSPEAK	GNSE			26.6	26.6
	GNSG		112.8		112.8
U/TRU Solidification	GNSE			3.4	3.4
	GNSG	7.4	169.2	10.0	186.6
Acid Recovery					0
Solvent Recovery					0
HAW					0
LAW					0
Waste Handling	GNSG	4.8			4.8
Analytical					
Chemical Receipt					
Balance of Plant					
Subtotal		**86.1**	**789.6**	**80.1**	**955.8**
TOTAL	**955.8**				

Waste Characterization Codes used:
1st character G-greater than Class C
2nd character N-non-hazardous
3rd character S-solid
4th character A-universal canister for hulls, hardware, etc., E-engineered container, G-GTCC waste disposal container

The following Waste Characterization Codes are reflected in Table 5.2-1.

Waste Characterization Code: GNS**A**
Description: Wastes covered by this Code are GTCC solid wastes requiring disposal in a geologic repository
Example(s):
- Compacted hulls and hardware from Shearing and Dissolving

Disposition Path: Package into high level waste canisters 2' diameter x 10' high for disposal at a geologic repository
Technical Issues:
- The waste form requires qualification for disposal at the high level waste repository
- The repository for GTCC waste has not been identified

Waste Characterization Code: GNS**E**
Description: Wastes covered by this Code are GTCC solid wastes requiring disposal in a geologic repository that are not suitable for packaging into "standard" GTCC waste containers (Standard GTCC waste containers are assumed to be similar to those currently accepted at WIPP such as the standard waste box (SWB) and the standard large box 2 (SLB2))
Example(s):
- Large failed equipment from the following systems:
  - Offgas Capture and Disposal
  - U/Tc Separation
  - Cs/Sr Solidification, Packaging, Storage and Disposal
  - TRUEX
  - TALSPEAK
  - U/TRU Solidification, Packaging, Storage and Shipping

Disposition Path: Package into engineered containers designed to meet the requirements of the GTCC waste repository
Technical Issues:
- The repository for GTCC waste has not been identified
- Waste Acceptance Criteria for the GTCC repository are not developed
- Design criteria for GTCC waste disposal packages are not known

Waste Characterization Code: GNS**G**

Description: Wastes covered by this Code are GTCC solid wastes requiring disposal in a geologic repository that are suitable for packaging into "standard" GTCC waste containers (Standard GTCC waste containers are assumed to be similar to those currently accepted at WIPP such as the standard waste box (SWB) and the standard large box 2 (SLB2))

Example(s):

- Absorbed iodine on silver mordenite from the Offgas Capture and Disposal system
- Absorbed ^{14}C on $CaCO_3$ from the Offgas Capture and Disposal system
- Used molds from the Tc Solidification, Alloying, Packaging, Storage and Disposal system
- Empty U/TRU storage containers from the U/TRU Solidification, Packaging, Storage and Shipping system
- Used shear blades from Shearing and Dissolving

Disposition Path: Package into GTCC waste containers designed to meet the requirements of the GTCC waste repository

Technical Issues:

- The repository for GTCC waste has not been identified
- Waste Acceptance Criteria for the GTCC repository are not developed
- Design criteria for GTCC waste disposal packages are not known
- The use of WIPP approved (or WIPP-like) containers may not be allowed at the GTCC repository

The following table summarizes the total annual volume of GTCC solid waste generated by final waste package type (i.e. universal containers, engineered containers and "standard" containers). Also shown in the table is the equivalent quantity of waste packages required for the given waste volume. Since engineered containers are yet to be designed, no equivalent package quantity is calculated. Universal containers are assumed to be 2' diameter by 10' tall (0.9 m^3 packaged volume) and contain 3,600 kg of compacted hulls and hardware per container at a density of 4.35 g/cc. "Standard" GTCC waste disposal boxes are assumed to be equivalent to WIPP standard waste boxes (SWBs) with an internal volume of 1.6 m^3 (1.7 m^3 packaged volume) and loaded with an 80% packaging efficiency.

Table 5.2-2
Summary Of GTCC Solid Waste Packages

Universal Containers		Engineered Containers		"Standard" Containers	
Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity
57.8	70	69.8	---	828.5	647

The following table summarizes the total annual waste volume as packaged.

Table 5.2-3
Summary Of Packaged GTCC Solid Waste Volume

Universal Containers		Engineered Containers		"Standard" Containers	
Annual Package Quantity (From Table 5.2-2)	Annual Packaged Volume (m^3)	Annual Package Quantity (From Table 5.2-2)	Annual Packaged Volume (m^3)	Annual Package Quantity (From Table 5.2-2)	Annual Packaged Volume (m^3)
70	63.0	Unknown	87.3 (69.8÷0.80)	647	1,100.0

From Table 5.2-3 above, the overall volume of GTCC solid waste adjusted for packaging is 1,250.3 m^3.

5.3 Mixed GTCC Solid Waste (Waste Characterization Code GHSx)

Table 5.3-1
System Level Summary Of Mixed GTCC Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving					
Offgas					
UREX					
U/Tc Separation					
Tc Solidification	GHSE			3.6	3.6
U Solidification					
CCD/PEG					
Cs/Sr Solidification	GHSE			20.9	20.9
TRUEX					
FP Solidification	GHSE			34.1	34.1
TALSPEAK					
U/TRU Solidification					
Acid Recovery					
Solvent Recovery					
HAW					
LAW					
Waste Handling					
Analytical					
Chemical Receipt					
Balance of Plant					
Subtotal				**58.6**	**58.6**
TOTAL	**58.6**				

Waste Characterization Codes used:
1st character G-greater than Class C
2nd character H-hazardous
3rd character S-solid
4th character E-engineered container

The following Waste Characterization Codes are reflected in Table 5.3-1.

Waste Characterization Code: GHS**E**
Description: Wastes covered by this Code are GTCC solid wastes containing hazardous constituents requiring disposal in a geologic repository that are not suitable for packaging into "standard" GTCC waste containers (Standard GTCC waste containers are assumed to be similar to those currently accepted at WIPP such as the standard waste box (SWB) and the standard large box 2 (SLB2))
Example(s):

- Large failed equipment from the following systems:
  - Tc Solidification, Alloying, Packaging, Storage and Disposal
  - Cs/Sr Solidification, Packaging, Storage and Disposal
  - Fission Product Solidification, Packaging, Storage and Disposal

Disposition Path: Package into engineered containers designed to meet the requirements of the GTCC waste repository
Technical Issues:

- The repository for GTCC waste has not been identified
- Waste Acceptance Criteria for the GTCC repository are not developed
- Design criteria for GTCC waste disposal packages are not known
- The GTCC repository may not accept GTCC wastes with hazardous constituents or additional treatment may be required prior to disposal

Since all the mixed GTCC waste identified in Table 5.3-1 is designated to be disposed of in engineered containers that are yet to be designed, no equivalent package quantity is calculated. Assuming an 80% packing efficiency and a 5% increase in volume from the package itself, the packaged mixed GTCC waste volume is 76.9 m^3 (58.6 ÷ 0.80 x 1.05 = 76.9).

5.4 Low Level Solid Waste (Waste Characterization Code LNSx)

Table 5.4-1
System Level Summary Of Low Level Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt	LNSE	48.0			48.0
	LNSH	33.1		8.0	41.1
	LNSL	144.3	693.0	14.5	851.8
Shearing/Dissolving	LNSE		0	27.1	27.1
	LNSL		481.2	2.9	484.1
Offgas	LNSE	107.6	0	2.1	109.7
	LNSL		33.6	0	33.6
UREX	LNSE		0	39.2	39.2
	LNSL		202.2	0	202.2
U/Tc Separation	LNSE		0	11.6	11.6
	LNSL		86.2	10.3	96.5
Tc Solidification	LNSE		0	5.9	5.9
	LNSL		102.2	10.3	112.5
U Solidification	LNSE		0	27.0	27.0
	LNSL		389.7	12.7	402.4
CCD/PEG	LNSE		0	38.9	38.9
	LNSL		76.6	0	76.6
Cs/Sr Solidification	LNSE		0	8.3	8.3
	LNSL		233.3	3.4	236.7
TRUEX	LNSE		0	16.5	16.5
	LNSL		202.2	0	202.2
FP Solidification	LNSE		0	57.3	57.3
	LNSL		580.1	10.7	590.8
TALSPEAK	LNSE		0	16.8	16.8
	LNSL		76.6	0	76.6
U/TRU Solidification	LNSE		0	1.4	1.4
	LNSL	2.5	204.5	6.6	213.6
Acid Recovery	LNSE		0	21.6	21.6
	LNSL		105.9	10.0	115.9
Solvent Recovery	LNSE		0	82.6	82.6
	LNSL		719.2	0	719.2
HAW	LNSE		0	50.5	50.5
	LNSL		181.9	0	181.9
LAW	LNSE		0	27.9	27.9
	LNSL		181.9	0	181.9
Waste Handling	LNSL	135.5	1,243.9	4.7	1,384.1
Analytical	LNSL		1,868.7	7.0	1,875.7
Chemical Receipt			0	0	0
Balance of Plant	LNSE		0	137.0	137.0
	LNSL		7,848.9	7,165.0	15,013.9
	LNSS	1,200.0	0	0	1,200.0
Subtotal		**1,671.0**	**15,511.8**	**7,837.8**	**25,020.6**
TOTAL	**25,020.6**				

Waste Characterization Codes used:

1st character	L-low level
2nd character	N-non-hazardous
3rd character	S-solid
4th character	E-engineered container, H-high integrity container, L-low level waste disposal box, S-solidified low level waste disposal box

The following Waste Characterization Codes are reflected in Table 5.4-1.

Waste Characterization Code: LNS**E**

Description: Wastes covered by this Code are low level solid wastes that are not suitable for packaging into standard low level waste containers

Example(s):

- Large failed equipment from most systems
- Used multi-purpose canisters from Fuel Receipt, Storage, Disassembly and Transfer
- Absorbed ^{3}H on zeolite from the Offgas Capture and Disposal system
- Absorbed Kr and Xe on H-mordenite from the Offgas Capture and Disposal system
- Absorbed Ru on filter media from the Offgas Capture and Disposal system

Disposition Path: Package into engineered containers designed to meet the requirements of the low level waste disposal facility. Some wastes will require decay storage prior to disposal.

Technical Issues:

- The low level waste disposal facility is site specific and not yet identified
- Waste Acceptance Criteria for the low level waste disposal facility are not definite
- Design criteria for the low level waste disposal packages are not definite

Waste Characterization Code: LNS**H**

Description: Wastes covered by this Code are low level solid wastes that are suitable for packaging into standard high integrity low level waste containers

Example(s):

- Filters, solids and resins from Fuel Receipt, Storage, Disassembly and Transfer

Disposition Path: Package into high integrity containers designed to meet the requirements of the low level waste disposal facility.

Technical Issues:

- The low level waste disposal facility is site specific and not yet identified
- Waste Acceptance Criteria for the low level waste disposal facility are not definite

Waste Characterization Code: LNS**L**
Description: Wastes covered by this Code are low level solid wastes that are suitable for packaging into standard low level waste containers
Example(s):

- Machining chips from Fuel Receipt, Storage, Disassembly and Transfer
- Job control waste from most systems
- Contaminated piping and valves from many systems
- Minor maintenance waste from most systems such as ventilation filters, HEPA filters, glovebox gloves, failed piping and valves, manipulator arms, manipulator boots, etc.

Disposition Path: Package into containers designed to meet the requirements of the low level waste disposal facility.
Technical Issues:

- The low level waste disposal facility is site specific and not yet identified
- Waste Acceptance Criteria for the low level waste disposal facility are not definite
- Fluorescent lamps are assumed to be low mercury type lamps that meet the TCLP test for toxicity. If this is not the case and the lamps are considered hazardous (and contaminated), then the volume of mixed low level waste reflected in Table 5.5-1 will increase.

Waste Characterization Code: LNS**S**
Description: Wastes covered by this Code are low activity aqueous liquid wastes that have been solidified as low level solid wastes that are suitable for packaging into standard low level waste containers
Example(s):

- Solidified effluent from the Waste Water Treatment operations in the Balance of Plant system

Disposition Path: Package into containers designed to meet the requirements of the low level waste disposal facility.
Technical Issues:

- The low level waste disposal facility is site specific and not yet identified
- Waste Acceptance Criteria for the low level waste disposal facility are not definite

Table 5.4-2 below summarizes the total annual volume of low level solid waste generated by final waste package type (i.e. engineered containers, high integrity containers and "standard" containers). Also shown in the table is the equivalent quantity of waste packages required for the given waste volume. The following assumptions are made to estimate the quantity of waste packages:

- Engineered containers are yet to be designed; therefore, no equivalent package quantity is calculated.
- High integrity containers are assumed to have a capacity of 0.2 m^3 and loaded with an 80% packing efficiency (effective volume = 0.16 m^3).
- Standard low level waste disposal boxes are assumed to have a capacity of 2.5 m^3 and loaded with an 80% packaging efficiency (effective volume = 2.0 m^3). The 2.5 m^3 low level waste packages are used for typical low level solid waste.
- Waste packages with a volume of 1.2 m^3 are used for solidified low activity waste. No allowance for packing efficiency is made (i.e. 100% packing efficiency).

Since the estimated waste volumes reflect the volume of waste as generated with no allowances made for waste minimization techniques such as compaction, the table also indicates an estimated quantity of standard low level waste disposal boxes assuming the waste is reduced by compaction to 25% of the original volume (with a 100% packing efficiency). The estimation of compacted package quantity assumes that 100% of the waste is suitable for compaction (applicable only to waste disposed of in 2.5 m^3 low level waste disposal boxes). In reality this assumption will not be valid. Not all waste streams disposed of in 2.5 m^3 standard boxes will be suitable for compaction; therefore, the actual package quantity that can be expected will lie somewhere between the uncompacted and compacted package quantities.

Table 5.4-2
Summary Of Low Level Solid Waste Packages

Engineered Containers		High Integrity Containers		Standard Containers (2.5 m^3)			Standard Container (1.2 m^3)	
Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity (Uncompacted)	Annual Package Quantity (Compacted)	Annual Waste Volume (m^3)	Annual Package Quantity
727.3	---	41.1	257	23,052.5	11,526	2,305	1,200	1,000

The use of volume reduction techniques such as compaction will lower the overall volume of packaged waste generated. Table 5.4-3 below indicates the volume of low level solid waste adjusted for compaction where applicable. The following assumptions are made in addition to the assumptions above for Table 5.4-2 to estimate the quantity of waste packages:

- The waste designated for disposal in engineered containers is not likely to be suitable for compaction; therefore, the packaged volume will be slightly greater than that shown above in Table 5.4-2. A packing efficiency of 80% is assumed for waste designated for disposal in engineered containers.
- Although high integrity containers are assumed to have an internal capacity of 0.2 m^3, the external volume of the package is assumed to be slightly larger at 0.25 m^3.
- The external volume of standard low level waste disposal boxes is assumed to be essentially equivalent to the internal volume, i.e. 2.5 m^3 and 1.2 m^3.

Table 5.4-3
Summary Of Packaged Low Level Solid Waste Volume

Engineered Containers		High Integrity Containers		Standard Containers (2.5 m^3)		Standard Container (1.2 m^3)	
Annual Waste Volume (m^3)	Annual Packaged Volume (m^3)	Annual Quantity of Waste Packages (From Table 5.4-2)	Annual Packaged Volume (m^3)	Annual Quantity of Waste Packages (From Table 5.4-2)	Annual Packaged Volume (m^3)	Annual Quantity of Waste Packages (From Table 5.4-2)	Annual Packaged Volume (m^3)
727.3	909.0	257	64.0	11,526	28,815.0	1,000	1,200.0

From Table 5.4-3 above, the overall volume of packaged low level solid waste is 30,988 m^3. Allowing for compaction as indicated in Table 5.4-2, the packaged low level solid waste volume can be reduced to 7,936 m^3.

5.5 Mixed Low Level Solid Waste (Waste Characterization Code LHSx)

Table 5.5-1
System Level Summary Of Mixed Low Level Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt	LHSD			0.3	0.3
Shearing/Dissolving	LHSD			0.8	0.8
	LHSE			3.5	3.5
Offgas	LHSD			0.3	0.3
UREX	LHSD			0.3	0.3
U/Tc Separation	LHSD			0.3	0.3
Tc Solidification	LHSD			0.3	0.3
U Solidification	LHSD			0.3	0.3
CCD/PEG	LHSD			0.3	0.3
Cs/Sr Solidification	LHSD			0.3	0.3
TRUEX	LHSD			0.3	0.3
FP Solidification	LHSD			0.4	0.4
TALSPEAK	LHSD			0.3	0.3
U/TRU Solidification	LHSD			0.3	0.3
Acid Recovery	LHSD			0.3	0.3
Solvent Recovery	LHSD			0.3	0.3
HAW	LHSD			0.3	0.3
LAW	LHSD			0.3	0.3
Waste Handling	LHSD			1.5	1.5
Analytical	LHSD			2.5	2.5
Chemical Receipt				0	0
Balance of Plant	LHSD			2.9	2.9
Subtotal				**16.1**	**16.1**
TOTAL	**16.1**				

Waste Characterization Codes used:
1st character L-low level
2nd character H-hazardous
3rd character S-solid
4th character D-drum, E-engineered container

The following Waste Characterization Codes are reflected in Table 5.5-1.

Waste Characterization Code: LHS**D**
Description: Wastes covered by this Code are low level solid wastes containing hazardous constituents (mixed wastes) that are suitable for packaging into standard mixed waste disposal containers (i.e. drums)
Example(s):
- Contaminated instruments and electronic equipment from most systems
- Manipulator counterweights from several systems
- Leaded glovebox gloves from the Waste Handling system
- Contaminated lead acid batteries from the Balance of Plant system

Disposition Path: Package into containers meeting the requirements of the mixed waste treatment and disposal facility
Technical Issues:
- The mixed waste treatment and disposal facility may be site specific and not yet identified
- Waste Acceptance Criteria for the mixed waste treatment and disposal facility are not definite
- Characterization of the waste may be difficult

Waste Characterization Code: LHS**E**
Description: Wastes covered by this Code are low level solid wastes containing hazardous constituents (mixed wastes) that are not suitable for packaging into standard mixed waste disposal containers (i.e. drums)
Example(s):
- Large failed equipment from the Shearing and Dissolving system

Disposition Path: Package into engineered containers designed to meet the requirements of the mixed waste treatment and disposal facility
Technical Issues:
- The mixed waste treatment and disposal facility may be site specific and not yet identified
- Waste Acceptance Criteria for the mixed waste treatment and disposal facility are not definite
- Characterization of the waste may be difficult

The following table summarizes the total annual volume of mixed low level solid waste generated by final waste package type (i.e. drums and engineered containers). Also shown in the table is the equivalent quantity of waste packages required for the given waste volume. Since engineered containers are yet to be designed, no equivalent package quantity is calculated. Drums are assumed to have a capacity of 0.2 m^3 and loaded with a 50% packaging efficiency.

Table 5.5-2
Summary Of Mixed Low Level Solid Waste Packages

Drums		Engineered Containers	
Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity
12.6	126	3.5	---

The following table summarizes the total annual waste volume as packaged.

Table 5.5-3
Summary Of Packaged Mixed Low Level Solid Waste Volume

Drums		Engineered Containers	
Annual Package Quantity (From Table 5.5-2)	Annual Packaged Volume (m^3)	Annual Package Quantity (From Table 5.5-2)	Annual Packaged Volume (m^3)
126	25.2	Unknown	7.0 (3.5÷0.50)

From Table 5.2-3 above, the overall volume of mixed low level solid waste adjusted for packaging is 32.2 m^3.

5.6 Low Activity Liquid Waste (Waste Characterization Code LNLx)

Table 5.6-1
System Level Summary Of Low Activity Liquid Waste

System	Waste Characterization Code	Annual Waste Volume (liters)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt	LNLD			100	100
Shearing/Dissolving	LNLD			116	116
Offgas	LNLD			100	100
UREX	LNLD			80	80
U/Tc Separation	LNLD			40	40
Tc Solidification	LNLD			100	100
U Solidification	LNLD			100	100
CCD/PEG	LNLD			80	80
Cs/Sr Solidification	LNLD			60	60
TRUEX	LNLD			160	160
FP Solidification	LNLD			200	200
TALSPEAK	LNLD			160	160
U/TRU Solidification				0	0
Acid Recovery	LNLD			60	60
Solvent Recovery	LNLD			600	600
HAW	LNLD			100	100
LAW	LNLD			100	100
Waste Handling					
Analytical					
Chemical Receipt					
Balance of Plant					
Subtotal				**2,156**	**2,156**
TOTAL	**2,156**				

Waste Characterization Codes used:
1st character L-low level (low activity)
2nd character N-non-hazardous
3rd character L-liquid
4th character D-drum

The following Waste Characterization Codes are reflected in Table 5.6-1.

Waste Characterization Code: LNL**D**
Description: Wastes covered by this Code are low activity liquid wastes requiring treatment prior to disposal (typically organic)
Example(s):

- Contaminated used oil from most systems

Disposition Path: Package into containers meeting the requirements of the treatment and disposal facility
Technical Issues:

- The treatment and disposal facility may be site specific and not yet identified
- Waste Acceptance Criteria for the treatment and disposal facility are not definite

All of the low activity liquid waste listed in Table 5.6-1 is packaged in drums. Assuming a drum capacity of 200 liters and 90% fill, the total volume of waste listed in Table 5.6-1 is equivalent to 12.0 drums.

5.7 Hazardous Solid Waste (Waste Characterization Code NHSx)

Table 5.7-1
System Level Summary Of Hazardous Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt	NHSD			1	1
Shearing/Dissolving	NHSD			2.5	2.5
Offgas	NHSD			1	1
UREX	NHSD			1	1
U/Tc Separation	NHSD			1	1
Tc Solidification	NHSD			1	1
U Solidification	NHSD			1	1
CCD/PEG	NHSD			1	1
Cs/Sr Solidification	NHSD			1	1
TRUEX	NHSD			1	1
FP Solidification	NHSD			1	1
TALSPEAK	NHSD			1	1
U/TRU Solidification	NHSD			1	1
Acid Recovery	NHSD			1	1
Solvent Recovery	NHSD			1	1
HAW	NHSD			1	1
LAW	NHSD			1	1
Waste Handling	NHSD			2	2
Analytical	NHSD			10	10
Chemical Receipt	NHSD			1	1
Balance of Plant	NHSD			15	15.0
Subtotal				**46.5**	**46.5**
TOTAL	**46.5**				

Waste Characterization Codes used:
1st character N-non-radioactive
2nd character H-hazardous
3rd character S-solid
4th character D-drum

The following Waste Characterization Codes are reflected in Table 5.7-1.

Waste Characterization Code: NHS**D**
Description: Wastes covered by this Code are non-radioactive solid wastes containing hazardous constituents
Example(s):

- Failed instruments and electronic equipment from most systems
- Lead acid batteries from the Balance of Plant system

Disposition Path: Package into containers meeting the requirements of the hazardous waste treatment and disposal facility or package for return to a recycling vendor
Technical Issues:

- The hazardous waste treatment and disposal facility may be site specific and not yet identified
- Waste Acceptance Criteria for the hazardous waste treatment and disposal facility are not definite

All of the hazardous solid waste listed in Table 5.7-1 is packaged in drums. Assuming a drum capacity of 0.2 m^3 and a packing efficiency of 50%, the total volume of waste listed in Table 5.7-1 is equivalent to 465 drums. The packaged volume is, therefore, 93 m^3.

5.8 Hazardous Liquid Waste (Waste Characterization Code NHLx)

Table 5.8-1
System Level Summary Of Hazardous Liquid Waste

System	Waste Characterization Code	Annual Waste Volume (liters)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving					
Offgas					
UREX					
U/Tc Separation					
Tc Solidification					
U Solidification					
CCD/PEG					
Cs/Sr Solidification					
TRUEX					
FP Solidification					
TALSPEAK					
U/TRU Solidification					
Acid Recovery					
Solvent Recovery					
HAW					
LAW					
Waste Handling					
Analytical					
Chemical Receipt					
Balance of Plant	NHLD			100	100
Subtotal				**100**	**100**
TOTAL	**100**				

Waste Characterization Codes used:
1st character N-non-radioactive
2nd character H-hazardous
3rd character L-liquid
4th character D-drum

The following Waste Characterization Codes are reflected in Table 5.8-1.

Waste Characterization Code: NHL**D**
Description: Wastes covered by this Code are non-radioactive liquid wastes containing hazardous constituents
Example(s):

- Paint from the Balance of Plant system

Disposition Path: Package into containers meeting the requirements of the hazardous waste treatment and disposal facility or package for return to a recycling vendor
Technical Issues:

- The hazardous waste treatment and disposal facility may be site specific and not yet identified
- Waste Acceptance Criteria for the hazardous waste treatment and disposal facility are not definite
- Spent diluent from the CCD/PEG system has not been determined at the time this report was prepared. If the diluent ultimately chosen is hazardous, then the waste will be a mixed waste with a Waste Characterization Code of LHLD and will add to the volume stated in Table 5.8-1. The CCD/PEG spent diluent is currently assumed to be non-hazardous and given a Waste Characterization Code of LNLD.
- No off-spec or out of date chemicals were identified as waste based on the assumption of a disciplined chemical procurement and inventory program and return of off-spec chemicals to the manufacturer. Any out of date or off-spec chemicals generated are assumed to be adequately captured by the Analytical system waste. If off-spec or out of date chemicals are generated and require disposal, they have the potential to be listed hazardous waste.

All of the hazardous liquid waste listed in Table 5.8-1 is packaged in drums. Assuming a drum capacity of 200 liters and 90% fill, the total volume of waste listed in Table 5.8-1 is equivalent to 0.6 drums.

5.9 Non-hazardous Solid Waste (Waste Characterization Code NNSx)

Table 5.9-1
System Level Summary Of Non-Hazardous Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving	NNSU			25	25
Offgas	NNSU			10	10
UREX	NNSU			10	10
U/Tc Separation				0	0
Tc Solidification				0	0
U Solidification				0	0
CCD/PEG	NNSU			10	10
Cs/Sr Solidification	NNSU			10	10
TRUEX	NNSU			10	10
FP Solidification	NNSU			10	10
TALSPEAK	NNSU			10	10
U/TRU Solidification	NNSU			10	10
Acid Recovery				0	0
Solvent Recovery	NNSU			10	10
HAW	NNSU			10	10
LAW	NNSU			10	10
Waste Handling	NNSU			10	10
Analytical	NNSU			10	10
Chemical Receipt	NNSU			121.3	121.3
Balance of Plant	NNSU	21,449.9		8,596	30,045.9
Subtotal		**21,449.9**		**8,872.3**	**30,322.2**
TOTAL	**30,322.2**				

Waste Characterization Codes used:
1st character N-non-radioactive
2nd character N-non-hazardous
3rd character S-solid
4th character U-unspecified

The following Waste Characterization Codes are reflected in Table 5.9-1.

Waste Characterization Code: NNS**U**
Description: Wastes covered by this Code are non-radioactive and non-hazardous solid wastes
Example(s):

- Sludge from the sanitary waste water treatment operations of the Balance of Plant system
- Sanitary solid waste from the Balance of Plant system
- Clean failed piping and valves from most systems
- Failed equipment from the Chemical Receipt, Storage and Makeup system
- HVAC supply air filters, solid maintenance waste, fluorescent lamps and tires from the Balance of Plant system

Disposition Path: Package into containers meeting the requirements of the sanitary disposal facility
Technical Issues:

- Fluorescent lamps are assumed to be low mercury type lamps that meet the TCLP test for toxicity. If this is not the case and the lamps are considered hazardous, then the volume of hazardous waste reflected in Table 5.7-1 will increase.

All of the non-hazardous solid waste listed in Table 5.9-1 is designated for disposal in undefined packages. Assuming a packing efficiency of 80%, the total volume of waste listed in Table 5.9-1 is equivalent to 37,902.8 m^3 as packaged.

The use of compaction could decrease the volume of non-hazardous solid waste. To estimate the waste volume considering compaction, it is assumed that only the sanitary solid waste (21,440 m^3 out of the total 30,322.2 m^3) is compacted prior to disposal to 25% of its original volume. Based on this assumption and an 80% packing efficiency for the remainder of the non-hazardous solid waste, the overall volume of non-hazardous waste could be reduced to 16,462.8 m^3 [(21,440 x 0.25) + (30,322.2 – 21,440) ÷ 0.8 = 16,462.8].

5.10 Non-hazardous Liquid Waste (Waste Characterization Code NNLx)

Table 5.10-1
System Level Summary Of Non-Hazardous Liquid Waste

System	Waste Characterization Code	Annual Waste Volume (liters)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving	NNLD			4,417	4,417
	NNLO	$2.3x10^6$		0	2,300,000
Offgas				0	0
UREX				0	0
U/Tc Separation				0	0
Tc Solidification	NNLD			4,417	4,417
U Solidification	NNLO	$3.7x10^6$		0	3,700,000
CCD/PEG	NNLO	$0.2x10^6$		0	200,000
Cs/Sr Solidification	NNLD			5,300	5,300
	NNLO	$0.6x10^6$		0	600,000
TRUEX				0	0
FP Solidification	NNLD			17,667	17,667
	NNLO	$0.4x10^6$		0	400,000
TALSPEAK				0	0
U/TRU	NNLD			10,600	10,600
Solidification	NNLO	$0.3x10^6$		0	300,000
Acid Recovery	NNLO	38,736		0	38,736
Solvent Recovery				0	0
HAW	NNLO	$6.8x10^6$		0	6,800,000
LAW	NNLO	$1.8x10^6$		0	1,800,000
Waste Handling	NNLD			7,067	7,067
Analytical	NNLD			3,533	3,533
Chemical Receipt	NNLD			1,700	1,700
Balance of Plant	NNLD			4,200	4,200
	NNLO	$227.9x10^6$		3,525,842	231,425,842
Subtotal		**244,038,736**		**3,584,743**	**247,623,479**
TOTAL	**247,623,479**				

Waste Characterization Codes used:
1st character N-non-radioactive
2nd character N-non-hazardous
3rd character L-liquid
4th character D-drum, O-outfall

The following Waste Characterization Codes are reflected in Table 5.10-1.

Waste Characterization Code: NNL**D**
Description: Wastes covered by this Code are non-radioactive and non-hazardous liquid wastes (typically organic)
Example(s):
- Used oil from shielding windows
- Used oil from the Chemical Receipt, Storage and Makeup system
- Used motor oil from the Balance of Plant system

Disposition Path: Package into containers meeting the requirements of the treatment and disposal facility
Technical Issues:
- Shielding window oil is assumed to be clean. There is a chance that the oil could become contaminated in service. If this is the case it will be considered low activity liquid waste.

Waste Characterization Code: NNL**O**
Description: Wastes covered by this Code are non-radioactive and non-hazardous liquid wastes (typically aqueous)
Example(s):
- Sanitary liquid waste from the Balance of Plant system
- Non-contaminated steam condensate from most systems
- Treated effluent from the waste water treatment operations in the Balance of Plant system
- Fire system test water from the Balance of Plant system

Disposition Path: Release to a permitted outfall
Technical Issues:
- Some streams may require holdup and monitoring prior to release

58,901 liters of the non-hazardous liquid waste listed in Table 5.10-1 is packaged in drums. Assuming a drum capacity of 200 liters, the total volume of waste packaged in drums listed in Table 5.10-1 is equivalent to 295 drums.

Appendix A
Waste Adjustment Factors for a 100 MTHM/year Facility

A.1 Waste Adjustment Factors

Waste estimates for a 100 MTHM/year facility are based on the estimates developed for the 800 MTHM/year facility. The 800 MTHM/year estimates are adjusted on the basis given in the following tables:

Table A.1-1
Operational Waste

Waste Stream	Basis
From all systems except Balance of Plant (BOP)	Most if not all of these waste streams are directly related to capacity.
BOP sanitary liquid	This waste stream is directly related to staffing levels
BOP sanitary sludge	This waste stream is directly related to staffing levels
BOP sanitary solid	This waste stream is based on facility footprint. It is estimated that the facility footprint for a 100 MTHM/year facility is approximately 70% of an 800 MTHM/year facility.
BOP Waste water treatment effluent	This waste stream is primarily related directly to capacity.
BOP waste water treatment solidified waste	This waste stream is primarily related directly to capacity.
BOP contaminated sump and basin water	This waste stream is based on facility footprint. It is estimated that the facility footprint for a 100 MTHM/year facility is approximately 70% of an 800 MTHM/year facility.
BOP equipment decontamination solutions	The amount of installed equipment is probably proportional to the facility footprint which would imply an adjustment factor of 0.7; however, the equipment is likely to be smaller, be used less often and fail less often making a relation to capacity more appropriate.
BOP laundry effluent	This waste stream is directly proportional to the amount of protective clothing laundered.

Table A.1-2 Job Control Waste	
Waste Stream	**Basis**
From all systems	Job control waste is directly proportional to the number of workers that enter radiological areas.

Table A.1-3 Maintenance Waste	
Waste Stream	**Basis**
From all systems except Balance of Plant (BOP)	In general, these waste streams, including failed equipment, are directly related to capacity. The amount of installed equipment is probably proportional to the facility footprint which would imply an adjustment factor of 0.7; however, the equipment is likely to be smaller, be used less often and fail less often making a relation to capacity more appropriate.
BOP other than failed equipment	These waste streams are primarily based on facility footprint. It is estimated that the facility footprint for a 100 MTHM/year facility is approximately 70% of an 800 MTHM/year facility.
BOP failed equipment	The amount of installed equipment is probably proportional to the facility footprint which would imply an adjustment factor of 0.7; however, the equipment is likely to be smaller, be used less often and fail less often making a relation to capacity more appropriate.

A.2 System Level Adjusted Waste Forecast

Using the adjustment factors above, the waste data in Sections 5.1 through 5.10 of the report can be revised as shown below for a 100 MTHM/year spent fuel separations facility. The tables in this section of Appendix A correlate to the tables in the body of the report as follows:

Title	Table in Body of Report	Table in Appendix A, Section A.2
System Level Summary of High Level Solid Waste	Table 5.1-1	Table A.2.1-1
Summary of High Level Solid Waste Packages	Table 5.1-2	Table A.2.1-2
Summary of Packaged High Level Solid Waste Volume	Table 5.1-3	Table A.2.1-3
System Level Summary of GTCC Solid Waste	Table 5.2-1	Table A.2.2-1
Summary of GTCC Solid Waste Packages	Table 5.2-2	Table A.2.2-2
Summary of Packaged GTCC Solid Waste Volume	Table 5.2-3	Table A.2.2-3
System Level Summary of Mixed GTCC Solid Waste	Table 5.3-1	Table A.2.3-1
System Level Summary of Low Level Solid Waste	Table 5.4-1	Table A.2.4-1
Summary of Low Level Solid Waste Packages	Table 5.4-2	Table A.2.4-2
Summary of Packaged Low Level Solid Waste Volume	Table 5.4-3	Table A.2.4-3
System Level Summary of Mixed Low Level Solid Waste	Table 5.5-1	Table A.2.5-1
Summary of Mixed Low Level Solid Waste Packages	Table 5.5-2	Table A.2.5-2
Summary of Packaged Mixed Low Level Waste Volume	Table 5.5-3	Table A.2.5-3
System Level Summary of Low Activity Liquid Waste	Table 5.6-1	Table A.2.6-1
System Level Summary of Hazardous Solid Waste	Table 5.7-1	Table A.2.7-1
System Level Summary of Hazardous Liquid Waste	Table 5.8-1	Table A.2.8-1
System Level Summary of Non-Hazardous Solid Waste	Table 5.9-1	Table A.2.9-1
System Level Summary of Non-Hazardous Liquid Waste	Table 5.10-1	Table A.2.10-1

A.2.1 High Level Solid Waste

Table A.2.1-1
System Level Summary Of High Level Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving					
Offgas					
UREX					
U/Tc Separation					
Tc Solidification	HNSA	0.4			0.4
U Solidification					
CCD/PEG					
Cs/Sr Solidification	HHSE	9.8			9.8
TRUEX					
FP Solidification	HNSC	15.5			15.5
TALSPEAK					
U/TRU Solidification					
Acid Recovery					
Solvent Recovery					
HAW					
LAW					
Waste Handling					
Analytical					
Chemical Receipt					
Balance of Plant					
Subtotal		**25.7**			**25.7**
TOTAL	**25.7**				

The following summarizes the waste volumes presented above in terms of waste packages based on the assumptions outlined in Section 5.1 of the report.

Table A.2.1-2
Summary Of High Level Solid Waste Packages

Universal Containers		High Level Waste Containers		Engineered Containers	
Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity
0.4	0.8	15.5	13.3	9.8	510

Table A.2.1-3
Summary Of Packaged High Level Solid Waste Volume

Universal Containers		High Level Waste Containers		Engineered Containers	
Annual Package Quantity (From Table A.2.1-2)	Annual Packaged Volume (m^3)	Annual Package Quantity (From Table A.2.1-2)	Annual Packaged Volume (m^3)	Annual Package Quantity	Annual Packaged Volume (m^3)
0.8	0.7	13.3	17.3	510	9.8

From Table A.2.1-3 above, the overall volume of high level solid waste adjusted for packaging is 27.8 m^3.

A.2.2 GTCC Solid Waste

Table A.2.2-1
System Level Summary Of GTCC Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving	GNSA	7.3			7.3
	GNSG			0.1	0.1
Offgas	GNSE			0.1	0.1
	GNSG	2.0			2.0
UREX					0
U/Tc Separation	GNSE			0.1	0.1
	GNSG		72.8		72.8
Tc Solidification	GNSG	0.1	72.8		72.9
U Solidification					0
CCD/PEG	GNSG		72.8		72.8
Cs/Sr Solidification	GNSE			1.5	1.5
	GNSG		109.3		109.3
TRUEX	GNSE			3.4	3.4
FP Solidification					0
TALSPEAK	GNSE			6.8	6.8
	GNSG		72.8		72.8
U/TRU Solidification	GNSE			0.5	0.5
	GNSG	1.0	109.3	1.3	111.6
Acid Recovery					0
Solvent Recovery					0
HAW					0
LAW					0
Waste Handling	GNSG	0.6			0.6
Analytical					
Chemical Receipt					
Balance of Plant					
Subtotal		**11**	**509.8**	**13.8**	**534.6**
TOTAL	**534.6**				

The following summarizes the waste volumes presented above in terms of waste packages based on the assumptions outlined in Section 5.2 of the report.

Table A.2.2-2
Summary Of GTCC Solid Waste Packages

Universal Containers		Engineered Containers		"Standard" Containers	
Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity
7.3	8.8	12.4	---	514.9	402.3

Table A.2.2-3
Summary Of Packaged GTCC Solid Waste Volume

Universal Containers		Engineered Containers		"Standard" Containers	
Annual Package Quantity (From Table A.2.2-2)	Annual Packaged Volume (m^3)	Annual Package Quantity (From Table A.2.2-2)	Annual Packaged Volume (m^3)	Annual Package Quantity (From Table A.2.2-2)	Annual Packaged Volume (m^3)
8.8	7.9	Unknown	15.5 (12.4÷0.80)	402.3	683.9

From Table A.2.2-3 above, the overall volume of GTCC solid waste adjusted for packaging is 707.3 m^3.

A.2.3 Mixed GTCC Solid Waste

Table A.2.3-1
System Level Summary Of Mixed GTCC Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving					
Offgas					
UREX					
U/Tc Separation					
Tc Solidification	GHSE			0.5	0.5
U Solidification					
CCD/PEG					
Cs/Sr Solidification	GHSE			2.6	2.6
TRUEX					
FP Solidification	GHSE			4.3	4.3
TALSPEAK					
U/TRU Solidification					
Acid Recovery					
Solvent Recovery					
HAW					
LAW					
Waste Handling					
Analytical					
Chemical Receipt					
Balance of Plant					
Subtotal				**7.4**	**7.4**
TOTAL	**7.4**				

Since all the mixed GTCC waste identified in Table A.2.3-1 is designated to be disposed of in engineered containers that are yet to be designed, no equivalent package quantity is calculated. Assuming an 80% packing efficiency and a 5% increase in volume from the package itself, the packaged mixed GTCC waste volume is 9.7 m^3 (7.4 ÷ 0.80 x 1.05 = 9.7).

A.2.4 Low Level Solid Waste

Table A.2.4-1
System Level Summary Of Low Level Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt	LNSE	6.0			6.0
	LNSH	4.2		1.0	5.2
	LNSL	18.1	447.5	1.8	467.4
Shearing/Dissolving	LNSE		0	3.4	3.4
	LNSL		310.7	0.4	311.1
Offgas	LNSE	13.5	0	0.3	13.8
	LNSL		21.7	0	21.7
UREX	LNSE		0	4.9	4.9
	LNSL		130.6	0	130.6
U/Tc Separation	LNSE		0	1.5	1.5
	LNSL		55.7	1.3	57.0
Tc Solidification	LNSE		0	0.8	0.8
	LNSL		66.0	1.3	67.3
U Solidification	LNSE		0	3.4	3.4
	LNSL		251.7	1.6	253.3
CCD/PEG	LNSE		0	4.9	4.9
	LNSL		49.5	0	49.5
Cs/Sr Solidification	LNSE		0	1.1	1.1
	LNSL		150.7	0.5	151.2
TRUEX	LNSE		0	2.1	2.1
	LNSL		130.6	0	130.6
FP Solidification	LNSE		0	7.2	7.2
	LNSL		374.6	1.4	376.0
TALSPEAK	LNSE		0	2.1	2.1
	LNSL		49.5	0	49.5
U/TRU Solidification	LNSE		0	0.2	0.2
	LNSL	0.4	132.1	0.9	133.4
Acid Recovery	LNSE		0	2.7	2.7
	LNSL		68.4	1.3	69.7
Solvent Recovery	LNSE		0	10.3	10.3
	LNSL		464.4	0	464.4
HAW	LNSE		0	6.3	6.3
	LNSL		117.5	0	117.5
LAW	LNSE		0	3.5	3.5
	LNSL		117.5	0	117.5
Waste Handling	LNSL	16.8	803.3	0.6	820.7
Analytical	LNSL		1,206.7	0.9	1,207.6
Chemical Receipt			0	0	0
Balance of Plant	LNSE		0	17.2	17.2
	LNSL		5,068.4	5,015.5	10,083.9
	LNSS	150.0	0	0	150.0
Subtotal		**209.0**	**10,017.1**	**5,100.4**	**15,326.5**
TOTAL	**15,326.5**				

The following tables summarize the waste volumes presented above in terms of waste packages based on the assumptions outlined in Section 5.4 of the report. These tables correlate to Tables 5.4-2 and 5.4-3 in the body of the report.

Table A.2.4-2
Summary Of Low Level Solid Waste Packages

Engineered Containers		High Integrity Containers		Standard Containers (2.5 m^3)			Standard Container (1.2 m^3)	
Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity (Uncompacted)	Annual Package Quantity (Compacted)	Annual Waste Volume (m^3)	Annual Package Quantity
91.4	---	5.2	32.5	15,079.9	7,540	1,508.0	150.0	125

Table A.2.4-3
Summary Of Packaged Low Level Solid Waste Volume

Engineered Containers		High Integrity Containers		Standard Containers (2.5 m^3)		Standard Container (1.2 m^3)	
Annual Waste Volume (m^3)	Annual Packaged Waste Volume (m^3)	Annual Quantity of Waste Packages (From Table A.2.4-2)	Annual Packaged Waste Volume (m^3)	Annual Quantity of Waste Packages (From Table A.2.4-2)	Annual Packaged Waste Volume (m^3)	Annual Quantity of Waste Packages (From Table A.2.4-2)	Annual Packaged Waste Volume (m^3)
91.4	114.3	32.5	8.2	7,540	18,850	125	150.0

From Table A.2.4-3 above, the overall volume of packaged low level solid waste is 19,122.5 m^3. Allowing for compaction as indicated in Table A.2.4-2, the packaged low level solid waste volume can be reduced to 4,042.5 m^3.

A.2.5 Mixed Low Level Solid Waste

Table A.2.5-1
System Level Summary Of Mixed Low Level Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt	LHSD			0.1	0.1
Shearing/Dissolving	LHSD			0.1	0.1
	LHSE			0.5	0.5
Offgas	LHSD			0.1	0.1
UREX	LHSD			0.1	0.1
U/Tc Separation	LHSD			0.1	0.1
Tc Solidification	LHSD			0.1	0.1
U Solidification	LHSD			0.1	0.1
CCD/PEG	LHSD			0.1	0.1
Cs/Sr Solidification	LHSD			0.1	0.1
	LHSE			0	0
TRUEX	LHSD			0.1	0.1
FP Solidification	LHSD			0.1	0.1
TALSPEAK	LHSD			0.1	0.1
U/TRU Solidification	LHSD			0.1	0.1
Acid Recovery	LHSD			0.1	0.1
Solvent Recovery	LHSD			0.1	0.1
HAW	LHSD			0.1	0.1
LAW	LHSD			0.1	0.1
Waste Handling	LHSD			0.2	0.2
Analytical	LHSD			0.3	0.3
Chemical Receipt				0	0
Balance of Plant	LHSD			2.1	2.1
Subtotal				**4.8**	**4.8**
TOTAL	**4.8**				

The following table summarizes the waste volumes presented above in terms of waste packages based on the assumptions outlined in Section 5.5 of the report. This table correlates to Table 5.5-2 in the body of the report.

Table A.2.5-2
Summary Of Mixed Low Level Solid Waste Packages

Drums		Engineered Containers	
Annual Waste Volume (m^3)	Annual Package Quantity	Annual Waste Volume (m^3)	Annual Package Quantity
4.8	48	0.5	---

Table A.2.5-3
Summary Of Packaged Mixed Low Level Solid Waste Volume

Drums		Engineered Containers	
Annual Package Quantity (From Table 5.5-2)	Annual Packaged Volume (m^3)	Annual Package Quantity (From Table A.2.5-2)	Annual Packaged Volume (m^3)
48	9.6	Unknown	1.0 (0.5÷0.50)

From Table A.2.5-3 above, the overall volume of mixed low level solid waste adjusted for packaging is 10.6 m^3.

A.2.6 Low Activity Liquid Waste

Table A.2.6-1
System Level Summary Of Low Activity Liquid Waste

System	Waste Characterization Code	Annual Waste Volume (liters)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt	LNLD			13	13
Shearing/Dissolving	LNLD			15	15
Offgas	LNLD			13	13
UREX	LNLD			10	10
U/Tc Separation	LNLD			5	5
Tc Solidification	LNLD			13	13
U Solidification	LNLD			13	13
CCD/PEG	LNLD			10	10
Cs/Sr Solidification	LNLD			8	8
TRUEX	LNLD			20	20
FP Solidification	LNLD			25	25
TALSPEAK	LNLD			20	20
U/TRU Solidification				0	0
Acid Recovery	LNLD			8	8
Solvent Recovery	LNLD			75	75
HAW	LNLD			13	13
LAW	LNLD			13	13
Waste Handling					
Analytical					
Chemical Receipt					
Balance of Plant					
Subtotal				**274**	**274**
TOTAL	**274**				

All of the low activity liquid waste listed in Table A.2.6-1 is packaged in drums. Assuming a drum capacity of 200 liters and 90% fill, the total volume of waste listed in Table A.2.6-1 is equivalent to 1.5 drums.

A.2.7 Hazardous Solid Waste

Table A.2.7-1
System Level Summary Of Hazardous Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt	NHSD			0.2	0.2
Shearing/Dissolving	NHSD			0.3	0.3
Offgas	NHSD			0.2	0.2
UREX	NHSD			0.2	0.2
U/Tc Separation	NHSD			0.2	0.2
Tc Solidification	NHSD			0.2	0.2
U Solidification	NHSD			0.2	0.2
CCD/PEG	NHSD			0.2	0.2
Cs/Sr Solidification	NHSD			0.2	0.2
TRUEX	NHSD			0.2	0.2
FP Solidification	NHSD			0.2	0.2
TALSPEAK	NHSD			0.2	0.2
U/TRU Solidification	NHSD			0.2	0.2
Acid Recovery	NHSD			0.2	0.2
Solvent Recovery	NHSD			0.2	0.2
HAW	NHSD			0.2	0.2
LAW	NHSD			0.2	0.2
Waste Handling	NHSD			0.3	0.3
Analytical	NHSD			1.3	1.3
Chemical Receipt	NHSD			0.2	0.2
Balance of Plant	NHSD			10.5	10.5
Subtotal				**15.8**	**15.8**
TOTAL	**15.8**				

All of the hazardous solid waste listed in Table A.2.7-1 is packaged in drums. Assuming a drum capacity of 0.2 m^3 and a packing efficiency of 50%, the total volume of waste listed in Table A.2.7-1 is equivalent to 158 drums. The packaged volume is, therefore, 31.6 m^3.

A.2.8 Hazardous Liquid Waste

Table A.2.8-1
System Level Summary Of Hazardous Liquid Waste

System	Waste Characterization Code	Annual Waste Volume (liters)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving					
Offgas					
UREX					
U/Tc Separation					
Tc Solidification					
U Solidification					
CCD/PEG					
Cs/Sr Solidification					
TRUEX					
FP Solidification					
TALSPEAK					
U/TRU Solidification					
Acid Recovery					
Solvent Recovery					
HAW					
LAW					
Waste Handling					
Analytical					
Chemical Receipt					
Balance of Plant	NHLD			70	70
Subtotal				**70**	**70**
TOTAL	**70**				

All of the hazardous liquid waste listed in Table A.2.8-1 is packaged in drums. Assuming a drum capacity of 200 liters and 90% fill, the total volume of waste listed in Table A.2.8-1 is equivalent to 0.4 drums.

A.2.9 Non-Hazardous Solid Waste

Table A.2.9-1
System Level Summary Of Non-Hazardous Solid Waste

System	Waste Characterization Code	Annual Waste Volume (m^3)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving	NNSU			3.2	3.2
Offgas	NNSU			1.3	1.3
UREX	NNSU			1.3	1.3
U/Tc Separation				0	0
Tc Solidification				0	0
U Solidification				0	0
CCD/PEG	NNSU			1.3	1.3
Cs/Sr Solidification	NNSU			1.3	1.3
TRUEX	NNSU			1.3	1.3
FP Solidification	NNSU			1.3	1.3
TALSPEAK	NNSU			1.3	1.3
U/TRU Solidification	NNSU			1.3	1.3
Acid Recovery				0	0
Solvent Recovery	NNSU			1.3	1.3
HAW	NNSU			1.3	1.3
LAW	NNSU			1.3	1.3
Waste Handling	NNSU			1.3	1.3
Analytical	NNSU			1.3	1.3
Chemical Receipt	NNSU			15.2	15.2
Balance of Plant	NNSU	15,016.3		6,017.0	21,033.3
Subtotal		**15,016.3**		**6,052.3**	**21,068.6**
TOTAL	**21,068.6**				

All of the non-hazardous solid waste listed in Table A.2.9-1 is designated for disposal in undefined packages. Assuming a packing efficiency of 80%, the total volume of waste listed in Table A.2.9-1 is equivalent to 26,335.8 m^3 as packaged.

The use of compaction could decrease the volume of non-hazardous solid waste. To estimate the waste volume considering compaction, it is assumed that only the sanitary solid waste is compacted prior to disposal to 25% of its original volume. 21,440 m^3 of sanitary solid waste are produced annually for an 800 MTHM/year facility. For a 100 MTHM/year facility, the volume of sanitary waste is estimated to be 15,008 m^3. Based on this assumption and an 80% packing efficiency for the remainder of the non-hazardous solid waste, the overall volume of non-hazardous waste could be reduced to 16,462.8 m^3 [(15,008 x 0.25) + (21,068.6 – 15,008) ÷ 0.8 = 11,327.8].

A.2.10 Non-Hazardous Liquid Waste

Table A.2.10-1
System Level Summary Of Non-Hazardous Liquid Waste

System	Waste Characterization Code	Annual Waste Volume (liters)			
		Operational	Job Control	Maintenance	Subtotal
Fuel Receipt					
Shearing/Dissolving	NNLD			553	553
	NNLO	287,500		0	287,500
Offgas		0		0	0
UREX		0		0	0
U/Tc Separation		0		0	0
Tc Solidification	NNLD	0		553	553
U Solidification	NNLO	462,500		0	462,500
CCD/PEG	NNLO	25,000		0	25,000
Cs/Sr Solidification	NNLD	0		663	663
	NNLO	75,000		0	75,000
TRUEX		0		0	0
FP Solidification	NNLD	0		2,209	2,209
	NNLO	50,000		0	50,000
TALSPEAK		0		0	0
U/TRU Solidification	NNLD	0		1,325	1,325
	NNLO	37,500		0	37,500
Acid Recovery	NNLO	4,842		0	4,842
Solvent Recovery		0		0	0
HAW	NNLO	850,000		0	850,000
LAW	NNLO	225,000		0	225,000
Waste Handling	NNLD	0		884	884
Analytical	NNLD	0		442	442
Chemical Receipt	NNLD	0		213	213
Balance of Plant	NNLD	0		2,940	2,940
	NNLO	176,200,000		2,468,089	178,668,089
Subtotal		**178,217,342**		**2,477,871**	**180,695,213**
TOTAL	**180,695,213**				

9,782 liters of the non-hazardous liquid waste listed in Table A.2.10-1 is packaged in drums. Assuming a drum capacity of 200 liters and 90% fill, the total volume of waste packaged in drums listed in Table A.2.10-1 is equivalent to 54.4 drums.

A.3 Facility Level Adjusted Waste Forecast

Using the adjusted waste volumes in Section A.2 above, the facility level waste data summary in Tables 4.0-1 and 4.0-2 of the report can be revised as shown below for a 100 MTHM/year spent fuel separations facility.

Table A.3-1
Facility Level Waste Generation Summary for a 100 MTHM Spent Fuel Separations Facility

Waste Type	Volume
High Level Solid	25.7 m^3
GTCC Solid	535 m^3
Mixed GTCC Solid	8 m^3
Low Level Solid	15,327 m^3
Mixed Low Level Solid	4.8 m^3
Low Activity Liquid	274 liters
Hazardous Solid	16 m^3
Hazardous Liquid	70 liters
Non-Hazardous Solid	21,069 m^3
Non-Hazardous Liquid	$181x10^6$ liters

Table A.3-2
Packaged Solid Waste Volumes for a 100 MTHM Spent Fuel Separations Facility

Waste Type	Packaged Waste Volume – No Compaction (m^3)	Packaged Waste Volume – With Compaction (m^3)
High Level Solid	27.8	Not Applicable
GTCC Solid	707	Not Applicable
Mixed GTCC Solid	10	Not Applicable
Low Level Solid	19,123	4,043
Mixed Low Level Solid	10.6	Not Applicable
Hazardous Solid	32	Not Applicable
Non-Hazardous Solid	26,336	11,328